

## CLAIMS

1. A microelectrochemical reaction chamber comprising an inlet for allowing passage of electrochemical reaction constituents into the reaction chamber, and at least two electrodes, the electrodes arranged to have, in use, electrical contact with the reaction fluid, the electrodes being connectable to a detection circuit arranged to detect a current flow between the electrodes, and arranged to generate a signal if the current falls outside a predetermined range, thereby indicating adverse reaction conditions.
2. A microelectrochemical reaction chamber according to claim 1 wherein at least two of the electrodes are arranged to apply a voltage across at least a part of the region through which the reaction constituents pass, in use, thereby inducing an electrochemical reaction between the constituents.
3. A microelectrochemical reaction chamber according to claim 2 wherein the electrodes used to induce the electrochemical reaction are the same as the electrodes used to detect a current flow.
4. A microelectrochemical reaction chamber according to claim 1 wherein the chemical reaction constituents form a mixture including a substrate, an enzyme, and a mediator.
5. A microelectrochemical reaction chamber according to claim 4 wherein the substrate comprises a xenobiotic compound.

6. A microelectrochemical reaction chamber according to claim 4 wherein the enzyme comprises a protein from the cytochrome P450 or flavin mono-oxygenase families.

5

7. A method of determining whether the reactions conditions in a microelectrochemical reaction chamber are correct comprising feeding reaction fluids in turn into a reaction chamber, monitoring the current flow between electrodes in the reaction chamber, determining whether the current flow lies outside a first defined range, and, if the current lies outside the first defined range, determining that the reaction conditions in the chamber are adverse.

10

15

8. The method according to claim 7 wherein the step of feeding reaction fluids into the chamber further comprises the steps of feeding mediator into the chamber, and subsequently feeding a substrate and an enzyme into the chamber.

20

9. The method according to claim 8 wherein the step of feeding mediator into the chamber further comprises the steps of monitoring the current flow between the electrodes when the reaction chamber contains mediator only, determining whether the current flow lies outside a second defined range, and, if the current lies outside the second defined range, determining that the reaction conditions in the chamber are adverse.

25

30

10. The method according to claim 7 wherein the step of feeding reaction fluids into the chamber further comprises the step of feeding a mixture of substrate, enzyme, and mediator into the reaction chamber.

35

11. The method according to claim 7 wherein the step of determining that the reaction conditions in the chamber are adverse further includes the step of determining that a bubble is located within the reaction chamber.
12. The method according to claim 7 wherein the step of determining that the reaction conditions in the chamber are adverse further includes the step of determining that the concentrations of reaction fluids within the reaction chamber are incorrect.
13. The method according to claim 7 wherein the step of determining that the reaction conditions in the chamber are adverse further includes the step of determining that a voltage applied across the electrodes is incorrect.
14. The method according to claim 7 further comprising the step of generating a signal to indicate whether the reaction conditions in the chamber are adverse.
15. The method according to claim 7 wherein the step of feeding reaction fluids into the chamber further comprises the step of feeding each reaction fluid into the chamber at a predetermined flow rate.
16. Apparatus for determining that the reaction conditions for a microelectrochemical reaction are adverse comprising a microelectrochemical reaction chamber and a detection circuit, wherein the microelectrochemical reaction chamber comprises:
- an inlet for allowing passage of electrochemical reaction constituents into the reaction chamber; and
  - at least two electrodes, the electrodes arranged to have, in use, electrical contact

with the reaction fluid, the electrodes being connected to the detection circuit;

and wherein the detection circuit comprises:

- a current detector arranged to detect and measure a current flow between the electrodes of the reaction chamber;
- a comparator for comparing the current to a predetermined range, and arranged to generate a signal for indicating whether the current lies outside the predetermined range, thereby indicating adverse reaction conditions.

17. A chamber for detecting the presence of molecules in an analyte comprising at least two electrodes, the electrodes being arranged to apply, in use, a voltage across at least a part of an analysis region, the electrodes being connectable to a detection circuit arranged to detect a current flow between the electrodes, and arranged to generate a signal if the current falls outside a predetermined range, thereby indicating adverse conditions in the analysis region.

18. The chamber of claim 17 arranged to detect the presence of analytes by optical means.

19. The chamber of claim 18 further comprising an analyte carrier for use in the detection of analytes in which laser radiation from a first source is used to detect the presence of an analyte by Raman scattering, the analyte carrier comprising:

- a substrate for supporting the analyte and having optical properties chosen to match the laser radiation from the first radiation source; and
- a conducting surface on a portion of the substrate for receipt of the analyte.

20. The chamber of claim 19 in which a laser radiation from a second laser radiation source is used to generate a field to enhance the Raman scattering, and in which the substrate has optical properties chosen to match the second radiation source.

21. The chamber of claim 19 or 20 arranged to detect the presence of analytes at the conducting surface.

22. The chamber of claim 19, 20 or 21 in which the conducting surface has deposited thereon a reporter dye having a binding molecule for selectively binding to an analyte molecule to be analysed.

23. The chamber of claim 22 in which the reporter dye is arranged so that, in use, the reporter dye is in an analysis region on binding with a molecule to be analysed.

24. The chamber of any of claims 19 to 23 in which the conducting surface comprises one of the electrodes.

25. A microelectrochemical reaction chamber comprising the chamber of any of claims 17 to 24 in which at least two of the electrodes are arranged to apply a voltage across at least a part of the region through which reaction constituents pass, in use, thereby inducing an electrochemical reaction between the constituents.

26. The microelectrochemical reaction chamber of claim 25 in which the electrodes used to induce the electrochemical reaction are the same as the electrodes used to detect a current flow.

27. A method of detecting the presence of a molecule in an analyte in a chamber, the method comprising the steps of:

- providing the analyte on an analysis region of a conducting surface;
- illuminating the analysis region with first laser radiation to cause Raman scattering;
- detecting radiation scattered from the analysis region by Raman scattering to detect the presence of the molecule;
- simultaneously illuminating the conducting surface with second laser radiation at an angle to the conducting surface to generate a field in the analysis region, wherein the field generated in the analysis region enhances the Raman scattering effect;
- monitoring the current flow between electrodes in the chamber;
- determining whether the current flow lies outside a predetermined range; and
- if the current lies outside the predetermined range, determining that the conditions in the chamber are adverse.

28. The method of claim 27 in which the step of determining that the condition in the chamber are adverse further includes the step of determining that a bubble is located within the chamber.

29. The method of claim 27 or 28 in which the step of determining that the condition in the chamber are adverse further includes the step of determining that the constitution of an analyte mixture is incorrect.

30. The method of claim 27, 28 or 29 in which the step of determining that the condition in the chamber are adverse further includes the step of determining that a voltage applied across the electrodes is incorrect.